

## INTEGRATED COMPUTER AIDED DESIGN TOOL

### COMPUTER APPENDIX

[0001] This application includes a Computer Listing Appendix on compact disc, hereby incorporated by reference.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0002] The present invention relates to a Computer Aided Drafting (CAD) tool and more particularly to a CAD tool that is adapted to be integrated into a known CAD system used for architectural design, such as the AutoCad system, in order to provide increased functionality of the architectural CAD system and specifically to facilitate the design of various building systems, such as a fire detection and alarm system, and enable the building system design to be incorporated on architectural drawings prepared by way of the architectural CAD system and additionally automate many aspects of the overall system design.

#### 2. Description of the Prior Art

[0003] Various computer aided design systems are known. For example, computer aided fire protection systems are generally known in the art. Such fire protection systems fall into two categories: fire detection and alarm systems and fire protection sprinkler system. For example, U.S. Patent No. 6,131,077; 5,227,983 and 5,557,537 relate to a stand alone CAD fire protection sprinkler system which

automatically routes various conduit systems, such as pipes, conduits and the like. The system disclosed in the '077 patent can be used for automatic layout, for example, of a fire protection sprinkler system, lighting system, HVAC system as well as various other systems. Unfortunately, the fire protection system disclosed in the '077 patent is configured as a stand alone CAD system. Since the fire protection design is normally layered on top of architectural floor plans, the architectural details of the building must be incorporated into the stand alone CAD system disclosed in the '077 patent. In situations where the architectural drawings have been done on another CAD system, the architectural details must be duplicated in the fire protection CAD system.

**[0004]** Computer aided fire detection and alarm systems are also known. For example, M.E.P. CAD, Inc. provides a computer aided fire detection and alarm system, known as AlarmCad (<http://www.alarmcad.com>). The AlarmCad system is also a stand alone CAD system. Although the AlarmCAD system allows for import and export of AutoCAD drawings, there are several problems with the AlarmCAD system. First, the AlarmCad system is configured as a stand alone CAD system, thus making it relatively expensive. Second, import of AutoCAD drawings into the AlarmCAD (or any other CAD system for that matter) is not perfect. Thus, once the drawings have been imported, the user will likely need to edit the drawings, which can be time consuming and cumbersome. Third, since the AlarmCAD system is a stand alone system, a user must be familiar with two CAD systems; AutoCAD and AlarmCAD. Fourth, the AlarmCAD stand alone system may not be compatible with later updates of AutoCAD and may not be able to emulate later revisions for several reasons. One reason is that newer implementations of AutoCAD are likely proprietary, thus resulting in corresponding updated versions of AlarmCAD lagging behind updated versions of the AutoCAD system. Another reason is that the updated versions of AutoCAD may be protected by Intellectual Property rights preventing the AlarmCAD stand alone CAD system from emulating the new changes in the AutoCAD system.

**[0005]** In order to avoid the problems mentioned above, one known system has been developed and is configured as an add on tool for a extremely well known architectural computer aided drafting system, known as AutoCad. This add on tool is disclosed in U.S. Patent No. 4,885,694. The add on tool, disclosed in the '694 patent, enables various devices, such as fire protection equipment, to be located on layout drawings that were originally created using the AutoCad system. As is known in the art, AutoCad is probably the most popular CAD system for architectural design. Thus, drawings that have been created in the AutoCad system need not be duplicated and may be simply imported into the AutoCAD system which incorporates the add on tool. Moreover, the problems mentioned above associated with stand alone CAD systems are avoided. The system disclosed in the '694 patent allows the various devices, such as fire detection and alarm devices, to be easily located on layout drawings. The system automatically inventories all of the fire protection equipment and creates a bill of material as well as a labor and material estimate. However, the system disclosed in the '694 patent still requires many of the tedious tasks normally performed in connection with a fire detection and alarm system to be formed manually, thus making the use of the fire protection add on tool disclosed in the '694 patent tedious. Thus, there is a need for a design tool which not only eliminates duplication of architectural drawings and avoid the problems associated with updates of the AutoCAD design system but also facilitates the fire protection design.

#### SUMMARY OF THE INVENTION

**[0006]** Briefly, the present invention relates to a Computer Aided Design (CAD) tool, configured as an add on tool for an architectural design CAD system, such as AutoCAD, to form an integrated design tool for designing various building systems, such as fire detection and alarm. The integrated design tool facilitates the design of, for example, a fire detection and alarm system, for a building without the need to duplicate any of the architectural designs. By configuring the system as an add-on tool, various

problems associated with known design tools configured as stand alone CAD systems are avoided. In one embodiment of the invention, the integrated design tool incorporates a fire protection icon for fire detection and alarm devices located, for example, on the AutoCAD task bar. This icon is provided with click and place functionality. In order to place a piece of equipment, for example, fire detection and alarm equipment, on the floor plan, the user simply clicks on the icon and places it at the desired location. In addition, the integrated design tool automates many of the tedious tasks normally associated with the rest of the overall system design. For example, one important feature of the invention is that the system is configured to automatically generate riser diagrams as well as eliminate a number of manual tasks normally associated with the system. Thus, the system in accordance with the present invention not only avoids duplication of the architectural drawings but facilitates the entire fire protection design for a building.

#### DESCRIPTION OF THE DRAWINGS

**[0007]** These and other advantages of the present invention will be readily understood with reference to the following specification and attached drawings wherein:

**[0008]** FIGS. 1-30 illustrate exemplary screen shots which demonstrate the functionality and use of the integrated fire detection and alarm system design tool in accordance with the present invention.

**[0009]** FIGS. 31-58 illustrate additional exemplary screen shots which further demonstrates the functionality and use of the present invention.

#### DETAILED DESCRIPTION

**[0010]** The present invention relates to a Computer Aided Drafting (CAD) tool for designing various systems, such as fire detection and alarm systems. Although the invention is described and illustrated with respect to a fire detection and alarm system, the breadth of the invention is applicable to various building systems, for example, low voltage systems, such as security systems, CCTV systems, as well as higher voltage

systems, such as lighting systems, electrical systems, and virtually any system which incorporates conduit, electrical or fluid, between devices. The design tool in accordance with the present invention is configured as an add on tool for an existing architectural design CAD system, such as AutoCAD, which facilitates the design of, for example, the fire detection and alarm system, for a building within the AutoCad environment. By configuring the system as an add on tool, duplication of architectural drawings is thus eliminated. In addition, the system in accordance with the present invention facilitates the design of the balance of the system design by way of a click and place function allows fire detection and alarm devices, for example, to be added to the architectural floor plans by clicking and placing icons in the desired location on the floor plan. In accordance with other features of the invention, the system automates many of the other tedious tasks normally associated with designing a fire detection and alarm system for a building. These tasks include:

- Linking of floor plan drawings. In the creation of a complete, for example, fire detection and alarm system design, multiple floor plan drawings are required. After the individual drawings have been created the design tool in accordance with the present invention simply links the drawings updating references to each other and correcting any conflicts.
- Automatic creation of riser drawings. The system automatically creates riser drawings from the floor plan.
- Automatic creation of point to point drawings. Point to point wiring diagrams are automatically created.
- Automatic creation of control equipment drawings. The integrated design tool creates detailed control equipment drawings.
- Creation of control equipment programming databases. Most fire alarm control equipment is microprocessor based and requires that it be programmed to accommodate

the devices connected to it by way of a system wiring network. The integrated design tool automatically creates the required control equipment programming database.

- Creation of reports. The integrated design tool automatically creates various reports as well as makes calculations for circuit loading, voltage drop decibel loss and tabulates wire and conduit lengths for material ordering purposes as well as the quantity of devices and material for labor estimating.
- Creation of technical manuals. The integrated design tool automatically creates technical manual by assembling pertinent catalog and data sheets stored in a user database.
- Automation of drawing tasks. Tasks that have been performed manually historically are automatically performed by the integrated tool. Some examples of these tasks include placement on drawings of fire alarm device information, such as device sequence number and circuit number. Another example relates to manual entry of wire fill information.
- Capture of design information during drawing preparation. Conventionally, the design of fire alarm and other low voltage systems is done during drawing preparation. This information is known to be transferred by manual means by other project documents and to the system software configuration. The add on design tool captures the design information as it is placed on the drawing, thereby reducing or eliminating the need for manually counting the devices, measuring distances and totaling these quantities during project activities. For example, the traditional method for generating a bill of materials and purchasing the equipment is done by counting devices and panels on the drawings and entering them on handwritten or electronic spread sheet.
- Linking design documentation to other project activities. This feature allows the integrated add on design tool to import field changes back on to the design documents. For example, changes to the system software made on the spot to accommodate

changes in the as built conditions can be imported back into the integrated fire protection design tool to automate the corresponding drawing changes.

- Linking multiple unrelated electronic drawing files into a cohesive drawing set.

Although AutoCAD and other computer aided design software provides the ability to prepare project drawings in a related manner, most project drawings are prepared as separate, unrelated files. For example, high rise building drawings are prepared as individual floor plan drawings. The integrated fire detection and alarm design tool provides a facility to build a list of these project drawings and other facilities and identify them as a single project. For example, a fire alarm circuit that is connected to smoke detectors on multiple floors must have sequence numbers on one floor drawing that do not duplicate the sequence numbers on another floor drawing. Another example is that the project that has a separate circuit of smoke detectors. The circuit numbers must be coordinated such that there is no duplication. Although the drawings continue to exist as separate files, the integrated fire protection system coordinates circuit and device sequences to avoid conflict and duplication.

**[0011]** FIGS. 1-58 illustrate examples of how the integrated fire protection design tool can be used to facilitate the design of a fire detection and alarm system. The computer appendix provides an exemplary implementation of this tool for an exemplary fire detection and alarm system.

**[0012]** Obviously, many modifications and variations of the present invention are possible in light of the above teachings. Thus, it is to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described above.